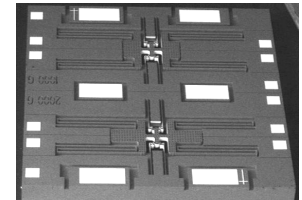


MEMS Technology

A technology revolution has occurred over the past decade in the area of miniaturization and manufacture of micron/millimeter-sized electro-mechanical devices. Through the development of this technology, known as MEMS, entire mechanical and electrical systems can be fabricated on a scale formerly reserved for micro-electronic systems. This combination of mechanical and electrical devices enables the design of very small Fuze/Safe and Arm (F/S&A) systems based on proven, conventional design concepts.



MEMS S&A Chip

Through its Materials, Engineering, and Physical Sciences Division, ONR is supporting MEMS technology research at the Naval Surface Warfare Center Indian Head Division. Researchers at Indian Head are developing MEMS technology and applying it to F/S&A systems, advanced sensors, and other DoD applications. The focus of these efforts is to apply MEMS technologies toward the development of a miniature F/S&A system for use in future underwater weapon applications. The initial planned uses of the miniature MEMS F/S&A are in the Canistered Countermeasure Set Anti-Torpedo (CCAT). In FY98 and FY99, MEMS S&A components and sensors were successfully tested in torpedo sea-run tests, and in FY01 a series of MEMS sea-run demonstrations were successfully conducted. A major accomplishment of the MEMS F/S&A development is the demonstration of robustness and reliability through innovative MEMS packaging techniques.



CCAT Fuze/S&A

The Indian Head team has developed miniature sensors by leveraging advancements in MEMS F/S&A technologies. Specifically, water/air flow sensors, a conductivity-temperature-pressure sensor suite, and high-G shock sensors are under development for underwater vehicle and weapon health monitoring. The flow sensor is also patented and licensed commercially for measuring boating speed. The shock sensor is in advanced development for application into the DoD Advanced Technology Ordnance Surveillance Radio-frequency Identification (ATOS RFID) tag system to monitor the high shock levels weapons experience.



Underwater Sensor using MEMS Technology

With ONR support, the Indian Head Division is currently setting its sights on the development of still smaller F/S&A devices for use in future DoD munitions. The next-generation devices will combine MEMS and micro-detonator technologies to provide S&A's with a greater than 5X reduction in size compared with current munitions S&A's (2.5 cu-in reduced to less than 0.5 cu-in). The proposed MEMS F/S&A will enable high (>99%) fuze reliability that will help reduce unexploded ordnance in the battlefield. Further, by integrating data-link/communications and advanced sensors in a <5 cc package, these fuzes will provide multi-mission compatibility and advanced warhead initiation.

Points of Contact

Judah Goldwasser, ONR 333 Program Manager
goldwaj@onr.navy.mil
703-919-1477

Lawrence Fan, NSWC IHDIV MEMS and Fuze Manager
Indian Head Division, NSWC, Code 4420F
Fanlc@ih.navy.mil

301-744-6157



www.onr.navy.mil